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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/715,000	11/20/2000	Hidemitsu Aoki	PF-2695	6696

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11/19/99

EXAMINER

LUU, CHUONG A

ART UNIT	PAPER NUMBER
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2825

DATE MAILED: 08/14/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/715,000

Applicant(s)

AOKI ET AL.

Examiner

Chuong A Luu

Art Unit

2825

-- The MAILING DATE of this communication appears on the cover sheet with the correspond nce address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 June 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-33 and 57-62 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-33 and 57-62 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

PRIOR ART REJECTION

Statutory Basis

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The Rejections

Claims 1, 4, 6 and 57-58 are rejected under 35 U.S.C. 102(b) as being anticipated by Nishitani et al. (U.S. 5,670,421)

Nishitani discloses a method of forming multiplayer wiring by

(1) carrying out an anti-corrosion treatment by exposing said surface of said

semiconductor substrate to a solution containing an anti-corrosive agent;

forming a copper-diffusion stopper insulating film over said surface of said

semiconductor substrate (see column 2, lines 22-63);

(4) wherein said anti-corrosion treatment is carried out subsequent to a cleaning process for removing metal contaminations from said surface of said substrate with a cleaning solution (see column 5, lines 64-67);

(6) wherein said anti-corrosion treatment is carried out at the same time as a cleaning process for removing metal contaminations from said surface of said substrate with use of a cleaning solution which is added with said anti-corrosive agent (see column 5, lines 64-67);

(57) wherein said step of carrying out an anti-corrosion treatment comprises flows the anti-corrosive agent onto the surface of the substrate (see column 5, lines 4-12);

(58) wherein said step of forming a insulating film comprises forming an insulating film by chemical vapor deposition (see column 5, lines 13-15).

Claims 2-3, 5, 7, 16, 18-23, 32 and 60-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishitani et al. (U.S. 5,670,421) in view of Obeng et al. (U.S. 6,323,131 B1).

Nishitani discloses a method of forming multiplayer wiring by

(18) carrying out an anti-corrosion treatment by exposing a surface of said semiconductor substrate to a solution containing an anti-corrosive agent;

forming a copper-diffusion stopper insulating film over said surface of said

semiconductor substrate (see column 2, lines 22-63);

(20) wherein said anti-corrosion treatment is carried out subsequent to a cleaning process for removing metal contaminations from said surface of said substrate with a cleaning solution (see column 5, lines 64-67);

(22) wherein said anti-corrosion treatment is carried out at the same time as a cleaning process for removing metal contaminations from said surface of said substrate with use of a cleaning solution which is added with said anti-corrosive agent (see column 5, lines 57-67);

(60) wherein said step of carrying out an anti-corrosion treatment comprises flows the anti-corrosive agent onto the surface of the substrate (see column 5, lines 4-12);

(61) wherein said step of forming a insulating film comprises forming an insulating film by chemical vapor deposition (see column 5, lines 13-15).

Nishitani discloses the above outlined features except for using copper interconnection, CMP process, carboxylic acid. However, Obeng discloses a method of forming passivating layer on the surface of copper by (18).... carrying out a chemical mechanical polishing process for forming said at least interconnection in at least a groove in said semiconductor substrate (column 2, lines 51-67);

(2) wherein said surface of said semiconductor substrate includes at least one of a copper interconnection, a copper based interconnection and a copper alloy interconnection which are formed in a damascene method (see column 2, lines 55-57);

(3) wherein said anti-corrosion treatment is carried out in a cleaning process after a chemical mechanical polishing process is carried out to said surface of said semiconductor substrate (see column 2, lines 60-61);

(5); (21) wherein said cleaning solution comprises a carboxylic acid based cleaning solution (see column 2, lines 62-63);

(7); (23) wherein said cleaning solution comprises a carboxylic acid based cleaning solution (see column 2, lines 62-63);

(16) (32) wherein said copper-diffusion stopper insulating film comprises an Si_3N_4 film (see column 1, line 39);

(19) wherein said anti-corrosion treatment is carried out in a cleaning process after a chemical mechanical polishing process is carried out to said surface of said semiconductor substrate (see column 3, lines 60-67). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the teachings of Nishitani and Obeng to fabricate a semiconductor device to exceed its performance.

Claims 17 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over over Nishitani et al. (U.S. 5,670,421)

Nishitani discloses the claimed invention except for using one of Si_3N_4 film and SiON film as copper-diffusion stopper insulating film material. It would have been obvious to one having ordinary skill in the art at the time the invention was made to substitute MoSi_2 that teaches by Nishitani (see column 2, lines 46-63) with Si_3N_4 film

and SiON film, which is a well-known material in the semiconductor industry, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Claims 33 and 62 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nishitani et al. (U.S. 5,670,421) in view of Obeng et al. (U.S. 6,323,131 B1).

Nishitani and Obeng disclose the claimed invention except for using Si₃N₄ film and SiON film as copper-diffusion stopper insulating film material. It would have been obvious to one having ordinary skill in the art at the time the invention was made to substitute MoSi₂ that teaches by Nishitani (see column 2, lines 46-63) and to substitute SiO₂ that teaches by Obeng (see column 4, lines 8-20) with Si₃N₄ film and SiON film, which is a well-known material in the semiconductor industry, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Claims 8-15, and 24-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishitani et al. (U.S. 5,670,421) in view of Obeng et al. (U.S. 6,323,131 B1) and further in view of Lawson (U.S. 4,978,756)

Nishitani and Obeng teach everything above except for using specific chemical compounds and concentrations for corrosive treatment and cleaning procedures.

However, Lawson discloses compounds can be used for the treatment of metal (8); (24) wherein said anti-corrosive agent comprises at least one of hetero-cyclic compounds and derivatives thereof; (9); (25) wherein said anti-corrosive agent comprises at least one selected from the groups consisting of four-membered hetero-cyclic compounds having two nitrogen atoms, five-membered hetero-cyclic compounds having three nitrogen atoms, six-membered hetero-cyclic compounds having three nitrogen atoms and derivatives thereof; (13); (29) wherein said anti-corrosive agent comprises at least one of aromatic compounds having benzene-rings and derivatives thereof; (14); (30) wherein said aromatic compounds having benzene-rings comprise gallic acids and tannic acids; (10); (26) wherein one of said four-membered hetero-cyclic compounds comprises indazole; (11); (27) wherein a plurality of said five-membered hetero-cyclic compound comprise benzotriazole, o-tolyltriazole, m-tolyltriazole, p-tolyltriazole, carboxybenzotriazole, 1-hydroxybenzotriazole, nitrobenzotriazole, and dihydroxypropylbenzotriazole; (15); (31) wherein at least one of gallic acids and tannic acids is contained in the range of 0.01% to 5% (see column 1, lines 4-8, lines 9-11; column 2, lines 5-66; column 3, lines 28-57; column 4, lines 4-44; column 7, lines 48-58; column 17, lines 10-50; and column 18, lines 57-68). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine the above teachings by apply certain chemical compounds and concentration to manufacture a semiconductor interconnection to enhance the performance of semiconductor device.

Response to Arguments

Applicant's arguments with respect to claims 1-33 and 57-62 have been considered but are moot in view of the new ground(s) of rejection.

Applicant argues that Obeng do not disclose forming two separate films by carrying out an anti-corrosion treatment by exposing a surface of a semiconductor substrate to a solution containing anti-corrosive agent and separately forming a copper-diffusion stopper insulating film. However, Nishitani discloses a method of forming multi-layer wiring (see column 2, lines 22-63).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chuong A Luu whose telephone number is (703)305-0129. The examiner can normally be reached on M-F (7:30-4:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (703)308-1323. The fax phone numbers for the organization where this application or proceeding is assigned are (703)308-7722 for regular communications and (703)308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.


CARIDAD EVERHART
PRIMARY EXAMINER

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August 9, 2002